Ab Initio Uncertainty Quantification of Neutrinoless Double-Beta Decay in ^{76}Ge

U.S. DEPARTMENT OF ENERGY | Office of Science

NUCLEI Nuclear Computational Low-Energy Initiative

Objective

The observation of neutrinoless double beta decay (NLDBD) would yield profound insights into the nature of neutrinos, their mass, and it might help explain the dominance of matter over antimatter in our universe.

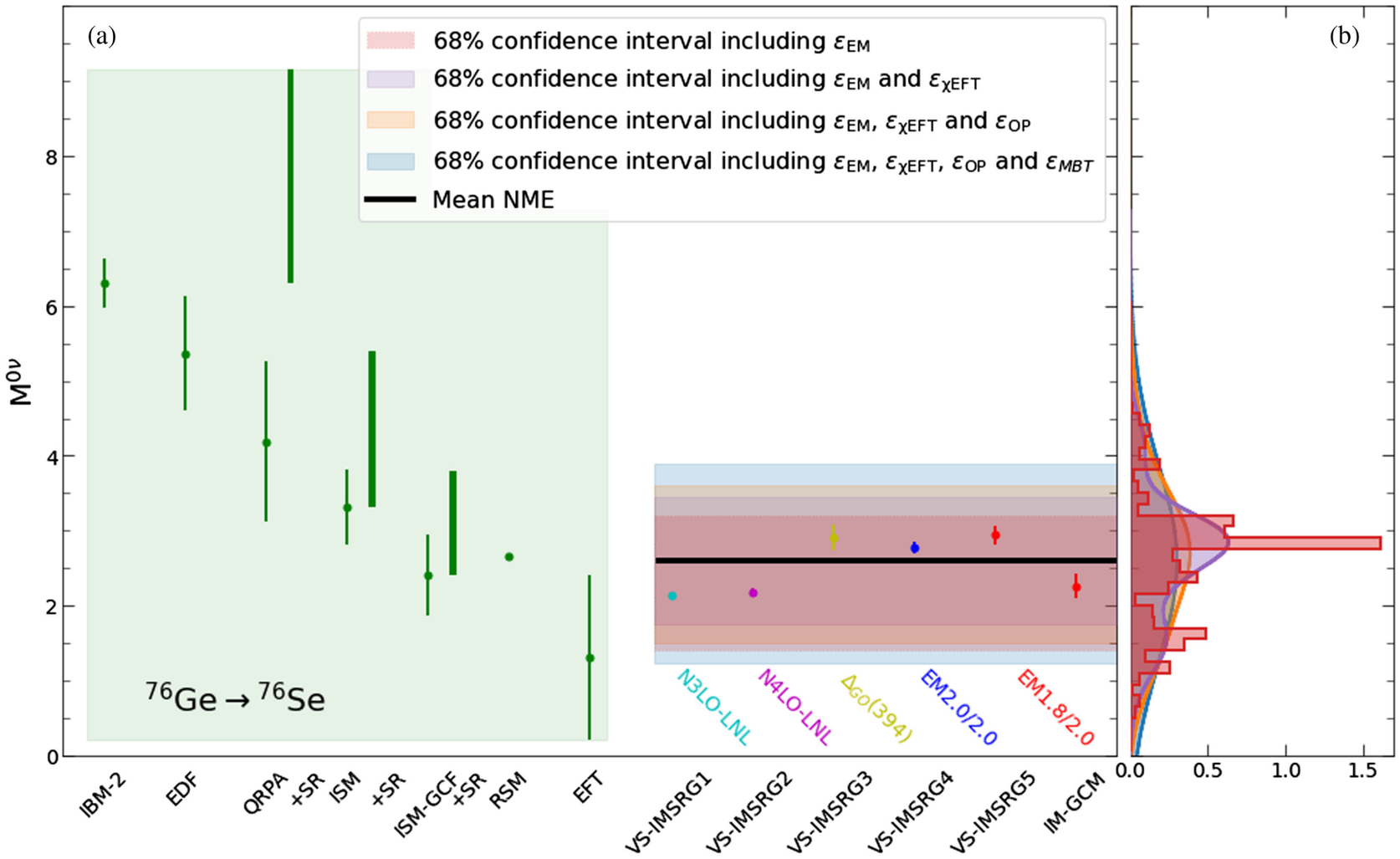
Impact

Using two complementary methods, VS-IMSRG and IM-GCM, we perform *ab initio* calculations of the nuclear (decay) matrix elements (NMEs) in ^{76}Ge, which are necessary to reliably extract the neutrino mass scale from experimental data, and to identify the primary drivers of theoretical uncertainties in current state-of-the-art approaches.

Accomplishments

- Published in PRL 132, 182502 (2024)

Comparison of NLDBD NMEs in ^{76}Ge from nuclear models and *ab initio* calculations.



(a) NMEs from phenomenological models and results from VS-IMSRG and IM-GCM using different chiral interactions. Error bars of phenomenological NMEs reflect the discrepancy between calculations from different groups.

(b) Posterior distribution function of the NME using a novel VS-IMSRG emulator with 8188 non-implausible chiral interactions from which confidence intervals are extracted.